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# Boundary Layer Effects on Mesoscale Phenomena

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## LONG-TERM GOALS

My long-term goal is to contribute to our understanding of the boundary layer on atmospheric fronts.

## OBJECTIVES

I wish to establish how cold frontal structure and intensity change as a front moves up or down a mountain slope. Various theoretical studies with no boundary layer show that the front weakens on the upwind side and strengthens on the lee side.

## APPROACH

We have added boundary layer parameterization terms to a finite difference numerical model, which predicts the movement and structure of a front as it moves over a two-dimensional mountain range. Various numerical experiments were carried out with and without the mountain and the boundary layer.

## WORK COMPLETED

We have carried out and analyzed various numerical experiments. In addition the terms in the frontogenesis equation have been calculated to enhance the interpretation of the results.

## RESULTS

We found that the boundary layer has a large effect on fronts moving over mountains. In particular, the cold front became stronger as it moved up the mountain slope that is appropriate to the behavior with no boundary layer. The frontogenesis terms were also quite different from the inviscid case.

## IMPACT/APPLICATION

Our results suggest the numerical prediction of fronts over mountains may be sensitive to initial conditions and boundary layer parameterization.

## TRANSITION

It is expected that these results will be used at NRL (West) in the development and evaluation of COAMPS.

**PUBLICATIONS**

Peng, M. S., Powell, J. H., Williams, R. T., and Jeng, B.-F, 2000: Boundary layer effects on fronts over topography, submitted to Journal of the Atmospheric Sciences.